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PATENT TRADEMARK OFFICE

Docket No: 9496/OL410

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Takashi Ohsaki

Serial No.: 09/615,104

Art Unit: 1754

Confirmation No.: 4085

Filed: 07/13/00

Examiner: Stuart Hendrickson

For: CARBONACEOUS NANOTUBE, NANOTUBE AGGREGATE, METHOD FOR MANUFACTURING A CARBONACEOUS NANOTUBE

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Pending Claims as of October 15, 2002

Assistant Commissioner for
Patents
Washington, DC 20231

October 15, 2002

Sir:

1. (Once Amended) A carbonaceous hollow nanotube comprising:
a carbon material and having an inner diameter less than or equal to 5nm; and an outer diameter wherein the difference between said outer diameter and said inner diameter is equal to or less than 20nm;

said carbon material comprising hydrogen atoms and carbon atoms;
wherein said nanotube is tube-shaped.

2. (Once Amended) The carbonaceous nanotube according to claim 1, wherein the difference between said outer diameter and said inner diameter is equal to or less than 10nm.

3. The carbonaceous nanotube according to claim 1, further comprising at least one transition metal atom.

4. (Once Amended) The carbonaceous nanotube according to claim 3, wherein said transition metal atom is iron.

5. (Once Amended) A fiber aggregate, comprising: carbonaceous hollow nanotubes comprising a carbon material and having an inner diameter of less than or equal to 5nm; and an outer diameter wherein the difference between said outer diameter and said inner diameter is equal to or less than 20nm;

said carbon material comprising hydrogen atoms and carbon atoms;

said carbonaceous nanotubes comprising at least 70 weight % of said fiber aggregate;

said hydrogen atoms comprising 0.1 to 1 weight % of said fiber

aggregate; and

said carbon atoms comprising at least 98.5 weight % of said fiber aggregate; wherein said nanotubes are tube-shaped.

6. (Once Amended) The fiber aggregate according to claim 5, wherein the difference between said outer diameter and said inner diameter is equal to or less than 10nm.

7. (Once Amended) The fiber aggregate according to claim 5, further comprising at least one transition metal atom.

8. The fiber aggregate according to claim 7, wherein said transition metal is iron.

9. (Once Amended) The fiber aggregate according to claim 7, wherein said at least one transition metal atom comprising 0.005 to 1 weight % of said aggregate.

10. A method for manufacturing a carbonaceous nanotube, comprising:
mixing a transition metal compound, containing at least one

transition metal atom, a sulfur compound, containing at least one sulfur atom, an organic compound containing a hydrocarbon, and a carrier gas, to obtain a raw material mixture;

supplying said raw material mixture to a reaction region maintained at a temperature of about 900 ~ 1,300°C inside a reaction tube;

adjusting said raw material mixture supply so that the concentration of said transition metal atom in said raw material mixture is in the range from about 0.025 ~ 0.5 mol %, and the concentration of said hydrocarbon in said raw material mixture is in the range represented by $(273/T - 1000)^4 \sim 10(73/T - 1000)$ mol %, wherein T represents the absolute temperature (K) of the reaction region.

11. The method for manufacturing a carbonaceous nanotube according to claim 10, wherein said transition metal compound is ferrocene.

12. The method for manufacturing a carbonaceous nanotube according to claim 10, wherein said sulfur compound is thiophene.